

## Chapter 10 Cost Estimating

### 10-1. Introduction

This chapter discusses considerations in estimating costs of SVE/BV systems.

### 10-2. Cost Estimating Strategy

The strategy and general approach to cost estimating for SVE/BV remediation are presented below.

*a. Establish the estimate type, goal, and accuracy.* Cost estimates should be prepared for various stages over the life of a remediation project. As more information is obtained about site conditions and proposed solutions, cost estimates typically become more precise and more detailed. Types of remedial action cost estimates are explained in ER 1110-3-1301 and are categorized as follows:

- (1) Preliminary Budget Estimate.
- (2) Feasibility Study (FS) Comparison Estimate.
- (3) Record of Decision (ROD) Estimate.
- (4) Current Working Estimate (CWE).
- (5) Government Estimate (G.E.).

Along with each of these cost estimates, the engineer must document assumptions used in preparing the estimate, provide an assessment of the accuracy of the costs, and provide a statement of limitations.

*b. Separate estimate into different categories.* Different categories of costs in estimates include site work, capital costs, nonconstruction costs (such as overheads, contingencies, and other markups), operations, maintenance and shutdown costs. Proper categorization is essential when using cost ratios; for example, process equipment replacement is often estimated as a percentage of capital equipment costs, particularly in early stage cost estimates. The capital equipment cost should not include items, such as earthwork, which require little or no equipment replacement. The Remedial Action Work Breakdown Structure (RA-WBS) and the Operations and Maintenance WBS provide standard structures for categorizing and reporting costs. The WBS is available at <http://www.environmental.usace.army.mil/info/technical/cost/costtool/costtool.html>.

*c. List cost components.* A list of cost components should be prepared. Components common to SVE/BV remediation are discussed throughout this manual and are listed in paragraph 10-4.

*d. Obtain cost information.* Cost information can be obtained from various cost data sources, including vendor quotes, cost estimating manuals, former actual remediation projects, and literature searches. Experienced cost engineers maintain files on former price quotes for common components. Prices should be obtained from several sources whenever possible. The cost engineer must be aware of exactly what is included in unit prices and document this information in the estimate. Software programs, such as RACER, can also be used to obtain cost information and develop cost estimates. More information on RACER can be found at the web site listed in paragraph *b.* above.

*e. Cost data analysis.* Cost information is often used to decide among remediation alternatives. It is also used to make financial decisions such as whether to lease or purchase. The goal of the estimate affects the method and level of detail of analysis. A detailed discussion of finance is beyond the scope of this manual; however, the cost engineer should be familiar with the following terms and concepts:

- Net present worth analysis.
- Rate of return method.
- Capitalized cost method.
- Depreciation methods.

These financial analysis tools should be used for appropriate decision making. More detailed financial and economic considerations (such as taxes, future interest rates, and future inflation rates) are typically not considered in engineering cost estimates for alternative analysis.

*f. Prepare assumptions and limitations.* Often the assumptions and limitations are of as much importance as the estimate itself. Examples of limitations are:

- Estimates are based on limited data, such as limited characterization or design information.
- Assumptions regarding the means and method of construction have been made.
- Prices of materials and labor fluctuate.
- Regulatory decisions are often unpredictable.

A typical list of assumptions will contain information regarding analysis of site conditions, quantities, project duration, and equipment. Sources of cost information, such as vendors and cost guides, should be referenced.

### **10-3. Cost Estimating Approaches**

The cost engineer must ensure that costs are based on the appropriate operating SVE/BV system. Operating costs can vary depending on the type and/or configuration of the SVE/BV system used. Likewise, the operating approach to remediation can change the operating cost. If cleanup is scheduled for a shorter period of time, the system may be larger, with a higher cost. If cleanup is allowed to take longer, a smaller system that may operate more efficiently could be used.

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#### 10-4. Cost Estimating Checklist

A suggested cost estimating checklist is provided in Table 10-1. This list includes most major SVE system cost components and has been divided into the following six categories: (a) Pilot Studies, (b) Site Work, (c) Treatment System Capital Components, (d) Nonconstruction, (e) Annual Operation and Maintenance, and (f) Shutdown. This is a typical list of cost components for preparing cost estimates for a feasibility study. Estimates for later design stages would likely be more detailed.

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**Table 10-1. Suggested Cost Estimating Checklist**

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##### **Pilot Studies**

- Equipment Rental or Lease
- Equipment Purchase
- Equipment Assembly
- Extraction Well and Piezometer Installation
  - Drilling
  - Materials
  - Supervision
- Impermeable Liner Construction
  - Materials
  - Labor
  - Construction Equipment and Operator
- Mobilization and Transportation of Equipment
- Onsite Labor to Conduct the Pilot Study
- Laboratory Analysis
- Data Validation and Interpretation
- Report Writing
  - QAPP
  - HASP
  - Contingency Plan
  - Air Monitoring Plan
  - Groundwater Monitoring Plan

##### **Site Work**

- SVE/BV Well and Piezometer Installation
  - Drilling
  - Materials
- SVE/BV Trench Installation
  - Earthmoving Equipment and Operator
  - Sand, Gravel, and Clean Fill
  - Geotextile Fabric
  - Soil Disposal
- Site Clearing
- Foundation or Pad
- Manholes
- Below-Ground Piping
- Below-Ground Electrical
- Surface Cover
- Building Construction

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**Table 10-1. (Continued)****Treatment System Capital Components****Major Components**

Air/Water Separator  
 Condensate Drop-Out Tank  
 Blower  
 Silencers  
 Air Filters  
 Carbon Vessels  
 Fume Incinerator  
     Burner  
     Catalyst  
     Heat Exchanger  
 VOC Monitor  
 O<sub>2</sub>/CO<sub>2</sub> Monitor

**Minor Components**

Piping  
 Valves  
 Gauges - Pressure, Temperature, and Flow  
 Electrical Controls and Wiring  
 Switches  
 Sampling Ports  
 Mounting Hardware  
 Painting  
 Lighting  
 Fire Extinguisher

**Nonconstruction**

Design  
 Permitting  
 Construction Management Supervision  
 Fees  
 Contingency  
 Start-Up

**Annual Operation and Maintenance (annualized for Net Present Worth)**

Treatment System Monitoring and Sampling  
 Environmental Sampling  
 Laboratory Analysis  
 Electricity  
 Fuel for Heating or Fume Incinerator  
 Carbon Replacement  
     Material  
     Labor  
     Disposal  
 Equipment Replacement  
 Labor for Maintenance  
 Condensate Disposal  
 Performance Evaluation and Optimization  
 Reporting  
 Regulatory Interactions

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Table 10-1. (Concluded)

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**Shutdown**

Final Sampling

Regulatory Interactions

Equipment Disassembly and Demobilization

Demolition

Salvage Value Credit (Negative Cost)

Reporting

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